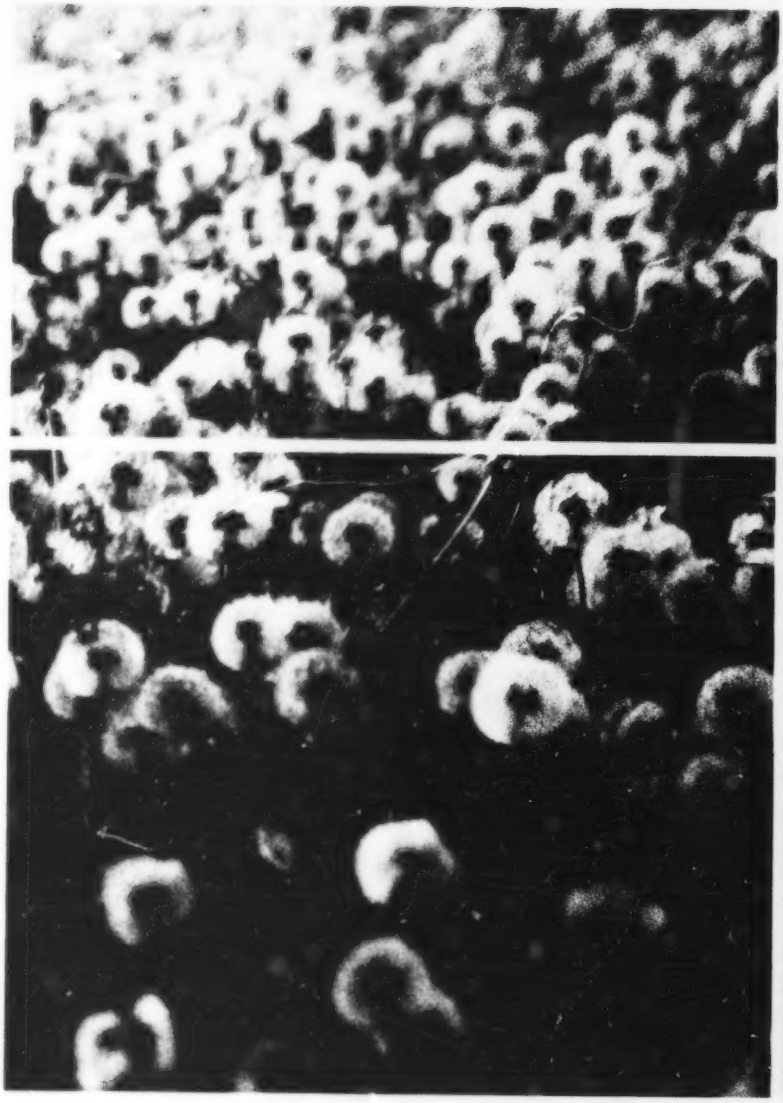
Alberta
ENVIRONMENTAL CENTRE

ANNUAL REVIEW
1985-86



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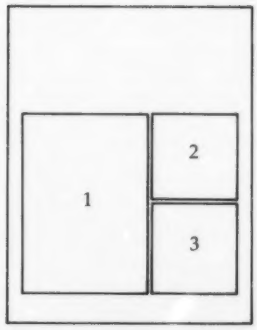

Cover photos: 1 Don Lobay
2,3 Sharon Novakowski

The Alberta Environmental Centre is the province's central facility for environmental research, technology development and services. Officially opened in 1981, the 16,700 square-metre main laboratory building is located on a 300-hectare site in Vegreville, 100 km east of Edmonton. Though funded by Alberta Environment, the Centre works for all provincial departments and agencies which identify environmental problems requiring study. Specific projects are undertaken after review by a Board of Directors and a Technical Advisory Committee. The Centre's five Wings — Plant Sciences, Chemistry, Animal Sciences, Environmental Technology and Common Services — accommodate around 300 staff carrying out applied studies to provide new knowledge for the solution of environmental problems.

Alberta
ENVIRONMENT

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Alberta Environmental Centre
Vegreville, Alberta

J. Bradley, Editor

AECV86-AR
ISSN 0715-6634
October 1986

This Report May Be Cited As:
Alberta Environmental Centre. Annual Review 1985-86.
Vegreville, Alberta. October, 1986.
48p. AECV86-AR

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AN OVERVIEW

The Alberta Environmental Centre worked for a growing list of provincial departments and agencies during the 1985-86 fiscal year, applying knowledge and expertise to the solution of environmental problems throughout Alberta.

The Departments of Agriculture, Energy and Natural Resources, Environment, Social Services and Community Health, and Workers' Health, Safety and Compensation, and the Alberta Research Council, continued as the Centre's major clients. As well, Alberta Economic Development demonstrated increasing interest in the commercial potential of processes and technologies being developed at the Centre. The Centre also carried out projects for another six departments and agencies. This work included waste incineration studies for Alberta Hospitals and Medical Care, industrial waste disposal research for the Alberta Special Wastes Management Corporation, and environmental isotope analysis for the Archaeological Survey of Alberta.

The information generated was put to practical use by provincial agencies across Alberta. For example, Centre scientists developed a method of determining safe consumption limits for fish contaminated with natural mercury, based on length of fish. This provided a valuable tool for fish resource managers and for the general public. A weed scientist developed a formula for estimating crop yield losses due to weeds. It has found application in Alberta and beyond. And the analytical results generated in laboratories were used daily in provincial monitoring, licensing and enforcement programs.

Centre activities also brought frequent contact with the private sector. For example, co-operative research on reclamation was undertaken with Syncrude Canada Ltd., and the Centre co-operated with private industry in several pollution abatement studies. Often, as with agricultural pest research, diagnostics and extension, the Centre's services were provided directly to the public.

Staff were increasingly active in the international scientific community during the year. In May, the Centre co-sponsored a conference in Banff where participants from 26 countries discussed toxicity testing using bacteria, an expanding area of research in which the Centre is active. Later, a Brazilian scientist worked for several weeks in Centre laboratories, learning microbiological toxicity testing techniques. In November, the Executive Director travelled to China's Heilongjiang Province as part of an Alberta science and technology delegation. This led to an agreement for a scientific exchange between Alberta and Heilongjiang. Staff also participated in co-operative studies with agencies such as the United States Environmental Protection Agency and the Commonwealth Institute of Biological Control in Switzerland.

The results of Centre studies were presented internationally as well as in Canada. Scientists wrote articles for many scientific journals and gave technical presentations in Canada, the United States, Europe and Asia. Staff published a number of technical reports, wrote one book and contributed chapters to several others.

These activities were financed through the Centre's $11.5 million budget, all of which was provided as part of the overall budget of Alberta Environment. The Centre undertook some important construction and development projects during the year, particularly in facilities for toxicology, waste management and furbearer research. A new pilot-scale mobile treatment plant was commissioned for on-location water studies and the Centre took delivery of a small mobile ozonation research unit for water treatment studies.

Work progressed in the three general areas of environmental services, research and technology development, highlighted below.

ENVIRONMENTAL SERVICES

The Centre provided services to all Albertans through agencies such as Health Units and Alberta Agriculture district offices. These services ranged from basic drinking water tests to specialized isotope studies in support of hydrology and archaeological studies.

Chemistry laboratories functioned as the core of service delivery, offering air, water and organic compound analyses. These tests supported provincial Health Units and environmental programs such as monitoring air quality, municipal and industrial effluents, pesticides and municipal drinking water. Staff performed emergency analyses in cases of chemical spills and other environmental incidents as well as undertaking more routine duties such as monthly tests for pesticides in drinking water.

Staff placed increasing emphasis on quality assurance and quality control activities throughout the Centre in order to maintain or improve the accuracy and reliability of test results supplied to clients.

Acting as Alberta Agriculture's Regional Crops Laboratory for northeastern Alberta, the Centre provided diverse crop protection advisory and information services to provincial agencies and to farmers and gardeners. Crop protection specialists identified weed, insect and plant disease problems and diagnosed cases of suspected chemical injury to plants.

Staff also delivered a wide range of other services, such as advising National Parks officials on the live capture of bighorn sheep using a netgun technique developed at the Centre, identification of vertebrate pests of agricultural concern, and information and field services in the area of environmental toxicology.

Overall, Centre staff handled more than 30,000 environmental samples of various types during the year.

RESEARCH

Studies to find practical solutions to environmental problems, both long- and short-term, constituted a significant portion of Centre work. These studies spanned time frames of a few weeks — such as research into whether leachate from irrigation canal liners affects crop growth — to several decades, as in studies on weed seed survival.

Where possible, the studies involved the input of several scientific disciplines, each investigating a problem from a different perspective. For example, in a study of black fly control near the Athabasca River, entomologists investigated novel on-farm control methods. Aquatic biologists and chemists looked into the effects of methoxychlor river treatment on non-target organisms in the Athabasca River, and veterinary toxicologists and pathologists assisted with studies on the effects of black fly control chemicals and biting fly attack on cattle.

Alberta Environmental Centre

Veterinarians and toxicologists also conducted several short-term, problem-solving studies into toxicology matters. For example, in co-operation with plant pathologists they investigated the potential of livestock poisoning from toxins produced by fungi in over-wintered, unharvested grain from the Peace River region.

The Centre recorded progress in a number of wildlife studies including an assessment of chemical residue levels in cormorants and in Peregrine falcon prey. Wildlife specialists also pursued studies into the potential and problems of commercial production of species such as elk and bison.

Staff began evaluating previously collected alpine grasses which show potential as a source of seed for high-altitude land reclamation projects. In further reclamation studies, soil specialists identified plant species with high rates of water uptake which may be useful in drying oil sand tailings sludges.

Several promising developments were recorded in research into non-chemical pest control. Introduced insects with potential for weed control survived the Alberta winter, and biological control in greenhouses and other interior environments continued to show promise as an alternative to or an adjunct to chemical control of insects.

The Centre developed methods of detecting residues of the herbicide Glean® in environmental samples, a difficult problem because of the extremely low rates of application of this chemical. Both chemical and biological tests were developed for detecting the residues.

TECHNOLOGY DEVELOPMENT

The Centre progressed in a number of areas concerned with the development of technology for pollution control and abatement. This included development and testing of both bench-and pilot-scale incinerators for research into the destruction of wastes by burning. And, in co-operation with a large hospital, scientists and engineers carried out tests on the incineration of hospital wastes and control of emissions.

In co-operation with government agencies and private firms in Canada and the U.S., the Centre developed and refined several laboratory tests for determining the effectiveness of waste solidification and stabilization processes.

Other staff members worked on problems such as the removal of color from pulp mill effluent. This included an assessment of a wastewater decolorization process proposed by a pulp mill, and studies on the use of fungi to remove effluent color.

The new mobile water treatment plant was taken into the field for the first time, investigating the removal from water of Giardia cysts. A small mobile analytical laboratory was developed to support the research plant, and a second mobile plant was acquired to study water ozonation.

PROGRAM AREAS

These activities in environmental services, research and technical development were undertaken in the following nine Program Areas, each representing a broad area of activity.

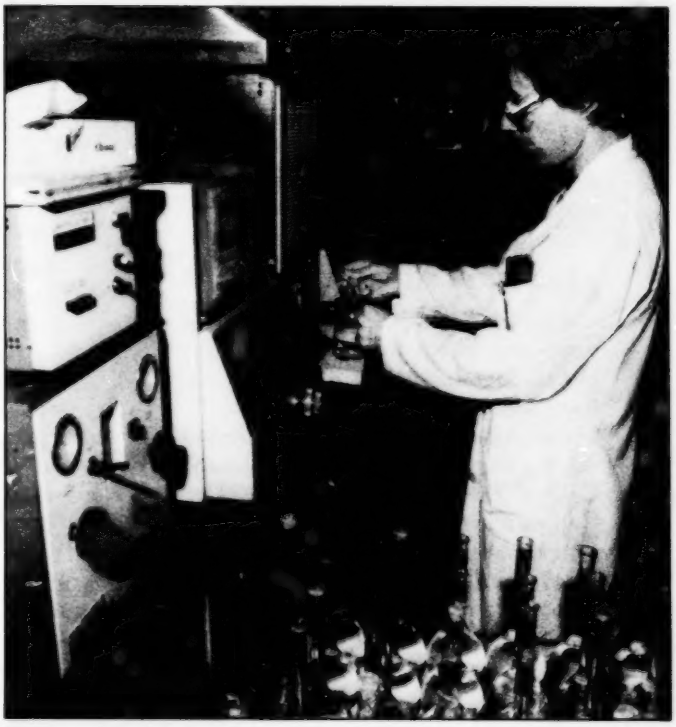
- Analytical, Diagnostic, Extension and Technical Services
- Pest Management Research and Development
- Water/Wastewater Management Research and Development
- Environmental Toxicology
- Living Natural Resources
- Waste Management Research and Development
- Land Resources Management Research and Development
- Technical Support
- Administrative Support

ANALYTICAL, DIAGNOSTIC, EXTENSION AND TECHNICAL SERVICES

Over one-half of the Centre's resources were devoted to providing an array of environmental services. These services entailed the detection and description of environmental substances and agents, ranging from chemical analyses to plant disease diagnosis.

PROGRAMS:

- Air Analytical Services
- Aquatic Biology Services
- Electron Microscopy
- Environmental Isotopes
- Lake Nutrients
- Microbiological Services
- Pest Management Diagnostic and Extension Services
- Precipitation Studies
- Quality Control and Data Management
- Research Services — Chemistry
- Soil Analytical Services
- Toxicology Services
- Trace Organic Analysis and Methods Development
- Water Analytical Services
- Wildlife Biology Services



Water analysis laboratory

AIR ANALYTICAL SERVICES

Analytical services were provided to Alberta Environment for the monitoring and enforcement of air quality regulations. Analyses were performed on approximately 7,500 ambient air and industrial stack samples involving over 22,000 individual tests. For example, ambient air samples collected from monitoring stations throughout Alberta were tested for lead and other metals, sulphur gases, nitrogen oxides, vinyl chloride and other substances.

Staff continued developing and adopting new test methods, such as sampling and analysis procedures for organic fatty acids in air. A new edition of the Centre's methods manual for air analysis was published. Results of analyses for vinyl chloride and urban suspended particulates were presented at scientific meetings.

The air analysis services laboratory conducted interlaboratory studies to validate industrial compliance monitoring data. It also acted as a reference laboratory for private and industrial laboratories in the province with regard to air analysis.

AQUATIC BIOLOGY SERVICES

Small-scale projects and services were provided on an as-required basis. These included the presentation of lectures and seminars, and writing of a book on changing environmental issues in developed nations. The Program also offered fish bioassay services in support of industrial effluent regulation.

ELECTRON MICROSCOPY

Electron microscope investigations were carried out for a number of clients and on various materials. Services were provided to Health Units, Alberta Environment, Alberta Agriculture and the Alberta Research Council as well as in support of Centre projects. Bacteria, viruses, fungal agents, sectioned and freeze dried animal tissues, fly ash, asbestos, pollen grains and blood cells were some of the materials routinely analysed.

During the year, a total of 528 electron microscope investigations were carried out.

A number of laboratory procedures were adopted for Centre purposes, and methods and quality assurance manuals were prepared. As well, internal and external quality control programs were implemented. Staff were trained in electron microscope examination of solidified hazardous wastes.

ENVIRONMENTAL ISOTOPES

Staff provided an environmental isotopes analysis service and applied research facility for the solution of environmental and earth science problems. This entailed use of the naturally occurring isotopes tritium and radiocarbon to determine the chronologies and rates of environmental processes such as sedimentation, aquifer recharge and archaeological events.

Tritium and radiocarbon analysis services were provided to approximately 20 projects being undertaken by provincial agencies, particularly the Alberta Research Council, Alberta Agriculture, Alberta Environment and the Archaeological Survey of Alberta. For example, samples were processed for dryland salinity research for Alberta Agriculture and the Alberta Research Council, archaeology studies for the Archaeological Survey of Alberta, and mercury pollution studies by the Centre.

LAKE NUTRIENTS

Staff provided analytical services to Alberta Environment's Water Quality Control Branch in support of the Branch's monitoring of chemical contaminants in surface waters. This involved analysis of water samples from rivers and lakes selected for intensive study over a one- to three-year period.

During the year, analyses were provided for major surveys of the North Saskatchewan and Athabasca Rivers. The Centre analysed 600 samples requiring approximately 20,000 chemical determinations for heavy metals, nutrients, and other substances relevant to eutrophication studies.

MICROBIOLOGICAL SERVICES

Staff in this Program provided microbiological identification and enumeration services and conducted toxicity tests using microorganisms.

The identification and enumeration services were provided to users in and outside the Centre. For example, plant pathogenic bacteria were identified, using computer-assisted identification schemes, for the Centre's Plant Pathology Section and for the Alberta Horticultural Research Station in Brooks. As well, bacterial fish pathogens were identified in the Centre's recycle water treatment system, and nitrifying and sulphate-reducing bacteria were isolated and enumerated in diverse samples. In total, 752 samples were analysed for 13,053 parameters. Work was also conducted on the refinement of identification tests and schemes, detection of selected bacterial groups, and electronic data analysis and report production.

Microbiologists continued to provide short-term toxicity testing services using microorganisms as the test species. These tests relied on determining the reaction of bacteria when exposed to potentially toxic materials. They were used on samples from potable and surface waters, industrial effluents, sanitary landfills, sludges and mine tailings ponds, requiring about 1,200 individual tests.

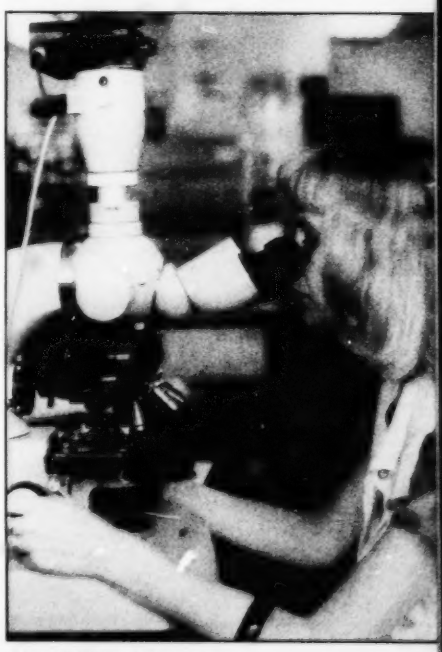
Microbiological services were supported by on-going quality control and quality assurance activities for monitoring equipment performance, sterility and selectivity of growth media and analysis of blind samples.

PEST MANAGEMENT DIAGNOSTIC AND EXTENSION SERVICES

Pest management specialists provided diagnostic services for weeds, insects and plant diseases and suspected chemical damage to plants. In doing so, the Centre functioned as Alberta Agriculture's northeastern and northcentral Regional Crops Laboratory, with responsibility for providing diagnostic and extension services to the province's other crops laboratories, and to extension workers, farmers and gardeners in this area.

In total, 1,777 specimens were submitted for diagnosis including 544 insects, 946 plant diseases and 287 weeds. An additional 584 plant bioassays and 433 instrumental analyses studies were conducted into suspected cases of chemical damage to plants, involving 725 plant, soil and water specimens.

Staff also responded to many inquiries for pest control and chemical damage information, prepared publications such as "Recognizing Herbicide Action and Injury", conducted an insect identification course and a weed inspectors school, prepared and manned public displays and participated in numerous other extension activities.



Microbiology laboratory

PRECIPITATION STUDIES

In this Program the Centre provided analytical services to Alberta Environment's acid rain monitoring program and participated in acid rain research.

Precipitation samples were routinely analysed from monitoring stations in the province. Approximately 300 samples were analysed for 4,000 parameters.

The Centre also participated in the federal-provincial Long Range Transport of Atmospheric Pollutants study, analysing 30 precipitation samples in three interlaboratory quality control studies.

Staff undertook a special joint study with Environment Canada to examine background levels of nitrates and sulphates in ice in Glacier National Park.

Program staff continued developing and adapting laboratory methods for precipitation analysis, presented research results at scientific conferences, and refereed scientific journal articles.

QUALITY CONTROL AND DATA MANAGEMENT

High priority was placed on internal Quality Assurance/Quality Control (QA/QC) concepts and practices, particularly to ensure that Centre analytical results are accurate and reliable.

Several collaborative QA/QC studies were initiated throughout the Centre. In particular, the Chemistry Wing, which undertakes most of the Centre's chemical analyses, updated laboratory test methods and began writing individual quality assurance manuals. Staff also undertook writing of a benchmark report on present QA/QC practices in the Centre which is expected to evolve into a five-year plan of quality control for the Centre.

RESEARCH SERVICES — CHEMISTRY

Staff in this Program provided technical resources and scientific expertise to research projects into the environmental fate and persistence of organic contaminants.

For example, an analytical method was developed for the analysis of the pesticide cypermethrin in cattle hair. The method was used to analyse over 100 samples in support of Centre studies into on-farm black fly control.

Technical support was provided for Centre evaluation of an experimental pulp and paper mill waste treatment process. This involved development of a data base allowing detection and measurement of over 230 compounds associated with pulp and paper mill operations. Over 40 samples were processed using this data base.

Researchers and technicians also participated in a study of the environmental effects of the pesticide methoxychlor, with the first phase requiring the analysis of water samples for residues of the chemical.

SOIL ANALYTICAL SERVICES

Soil analyses were provided to the Centre, government agencies and the public with land reclamation and environment related problems. Another goal of this Program was the development of new methods and equipment to help investigate the processes by which soils and plants respond to changing environmental conditions.

More than 2,000 soil samples were analysed during the year, with a large number completed for the on-going soil mapping of the Centre site. Specialized analyses were also carried out for soil gases, soil salinity, oil spills and sewage applications to land.

Staff also developed analytical methods to extract and measure the oil content of soil materials, to measure the effect of swelling clays on water movement, to monitor rates of plant transpiration and to quantify root growth in soil.

TOXICOLOGY SERVICES

Staff provided professional toxicological expertise and advice in response to a number of suspected or actual toxicological incidents.

In one case, staff investigated the effects on livestock of a natural gas well blowout, while in another, effects of a gas plant stack blowout on livestock feed were examined. Work continued in a case of suspected livestock health problems associated with sulphur block meltdown at a natural gas plant.

Toxicologists and plant pathologists conducted laboratory and field investigations into the potential production of toxins by fungi growing in grain overwintered in the swath. Fungi which are potential producers of the toxin were identified, and tested for production of the toxin.

A toxicology information project was maintained, to respond to numerous inquiries, particularly about livestock poisonings.

TRACE ORGANIC ANALYSIS AND METHODS DEVELOPMENT

Trace levels of organic contaminants were analysed in water, effluents, soils, sediment and other materials, mainly to provide information to Alberta Environment's Pollution Control Division. These analytical services were also provided to Provincial Health Units, to the Centre and to various other clients. A total of 1,317 samples involving 57,885 parameters was analysed for polychlorinated biphenyls (PCB's), hydrocarbons and priority pollutants.

Staff provided analytical support for the monitoring of selected water treatment plants which provide water to approximately half the population of Alberta.

Diverse industrial effluent samples were received as part of a survey of Alberta's river basins. This work entailed analysis of receiving waters and sediments from various locations on given water courses.

Laboratory support was provided to ensure the safe containment of a number of chemicals at different locations in Alberta, and hydrocarbons from spills or groundwater contamination were characterized for clients.

Development continued on new methods for detecting and measuring organic compounds in environmental samples and the results were presented at scientific conferences.

WATER ANALYTICAL SERVICES

A total of 13,918 samples was submitted under this Program, including samples for drinking water analysis, pollution monitoring and water quality investigations. As illustrated below, the major users were Public Health Units requiring drinking water quality tests, and the Pollution Control Division of Alberta Environment which used results to monitor and enforce environmental acts and regulations.

	Samples	Analytical Determinations
Health Units	7,188	106,579
Pollution Control Division	5,058	89,746
Alberta Environmental Centre	1,400	11,055
Other Departments	342	6,324
TOTAL	13,918	213,704

Field sampling and chemical analysis for a feedlot runoff study and a study of the Tri-Creeks watershed were completed. In addition, staff completed heavy metal analyses in fish tissues for various provincial studies initiated by the Centre and Alberta Energy and Natural Resources.

This year showed a decrease in Centre turnaround time from sample receipt to distribution of results.

WILDLIFE BIOLOGY SERVICES

This Program area provided small-scale projects and services and the development of new wildlife research programs and projects.

In the services area, for example, staff were asked by Jasper National Park personnel to assist with the live capture of bighorn sheep, using a net-gun capture technique developed at the Centre.

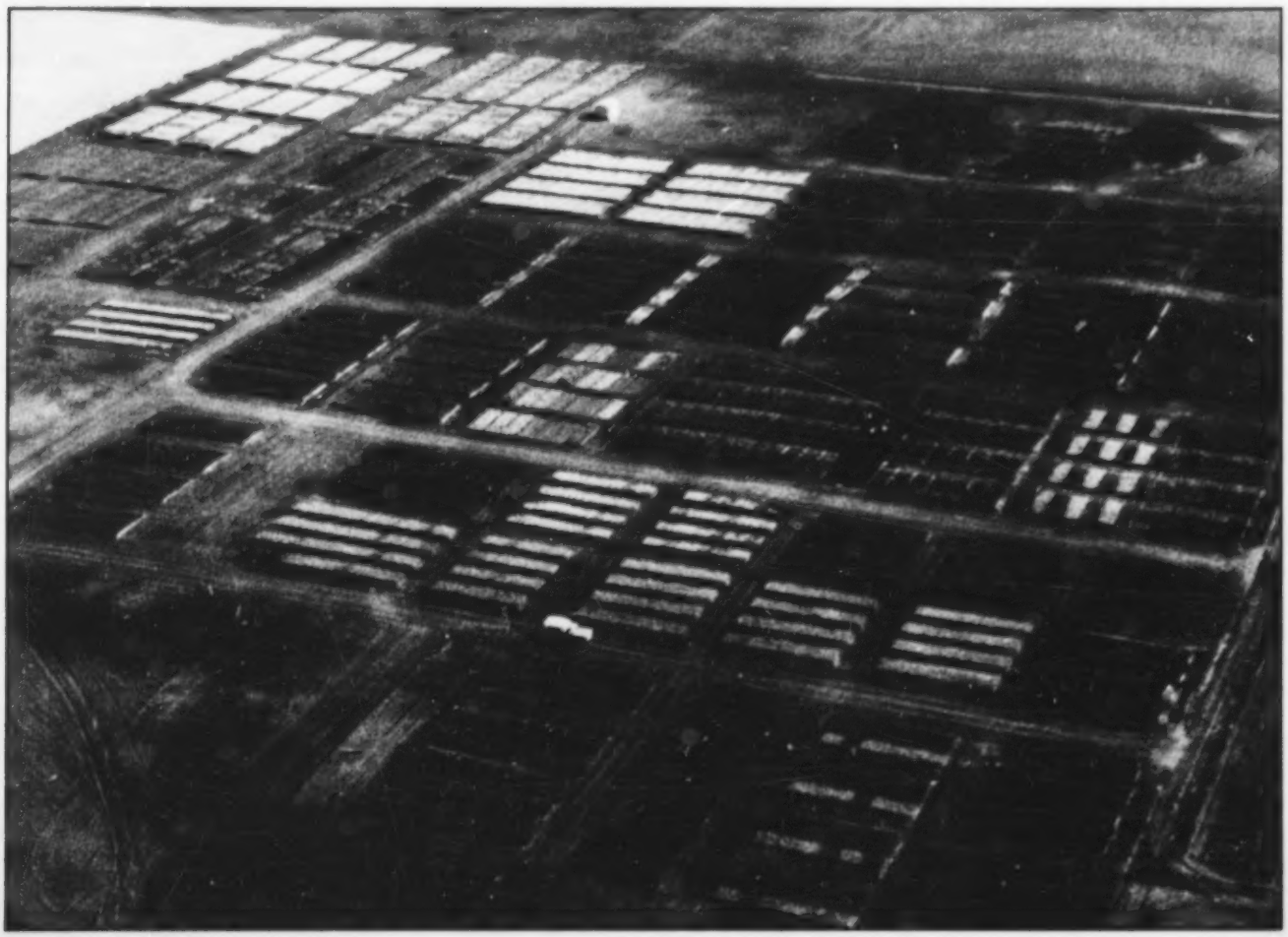
In the research development area, a field study was completed on the feasibility of conducting moose calf mortality studies in northeast Alberta. Staff were also asked to consider potential research on the impact of predation on caribou survival in northwestern Alberta.

PEST MANAGEMENT RESEARCH AND DEVELOPMENT

Research into ways of reducing pest damage through the use of integrated environmentally sound control was emphasized in this Program Area. Chemical, biological and cultural control methods were examined and chemical studies were carried out to detect and analyse pesticides in the environment.

PROGRAMS:

- Biological Control of Weeds Research and Development
- Biology and Ecology of Weeds Research and Development
- Herbicides and Weed Management Research and Development
- Insect Pest Management Research and Development
- Pesticide Analysis and Methods Development
- Plant Pathology Research and Development



Field research plots

BIOLOGICAL CONTROL OF WEEDS RESEARCH AND DEVELOPMENT

The Centre carried out a comprehensive biological weed control program aimed at developing effective and environmentally sound control of particular problem weeds. This entailed studies to determine target weeds for biological control, identification and screening of potential control insects and their release and monitoring in Alberta.

Staff compiled a priority list of weeds which might be controlled biologically. As well, the insects which attack scentless chamomile in the weed's native areas of Alberta were surveyed.

Scientists at the Centre, in co-operation with other agencies in Regina and Switzerland, conducted screening trials to ensure that imported insects attack only the target weed. Several insect species from Europe which have potential for controlling Alberta weeds were screened for possible release in the province.

Insects which had passed the screening were released in studies on leafy spurge and toadflax control. Insect colonies were also maintained in growth chambers in preparation for release on Canada thistle and leafy spurge.

Staff continued monitoring the status of insects which had been released in previous years. Two species of flea beetle on leafy spurge were found to have survived the winter near Cardston as did a gall midge species on perennial sow thistle at Vegreville.

BIOLOGY AND ECOLOGY OF WEEDS RESEARCH AND DEVELOPMENT

A major research project was conducted on the extent of crop losses due to weeds and on the costs and benefits of weed control with herbicides. Field trials were conducted on the competitive influence of selected weeds on canola and cereal crops, leading to development of practical methods of predicting cereal losses from wild oats and tartary buckwheat.

Scientists continued long-term trials to determine the re-infestation potential of wild oats present below the density where chemical control is economical.

Studies were conducted on the competitiveness of smartweed, hemp nettle and green foxtail under different growing conditions. A project was also completed on the intraspecific competitive effects of smartweed.

Studies on weed classification continued to provide information necessary for biological and chemical weed control. Taxonomy studies were conducted on leafy spurge. Electron microscope examinations of knotweed seed were carried out to determine if two species of this weed exist in Alberta.

Staff participated in weed surveys to document changes occurring in weed populations and to identify major weed problems, and completed a literature review on ecology of the Alberta parklands.

HERBICIDES AND WEED MANAGEMENT RESEARCH AND DEVELOPMENT

Thirty-seven field trials were conducted to generate a range of information for the safe and effective use of herbicides.

In one group of studies, scientists studied the performance of new and registered herbicides for weed control in wheat, barley and canola. The influence of additives on herbicide activity was also determined. Information generated was used in registering herbicides and in making weed control recommendations to Alberta farmers.

Staff also studied the safety of herbicides to crops. This included trials on the tolerance of new barley, wheat and canola varieties to herbicides and the effect of soil carryover of herbicides on succeeding crops. Related research investigated the effects of herbicide application on disease development in barley and wheat and the effects of herbicide drift on non-target crops.

Researchers conducted several studies to understand the activity, persistence and degradation of herbicide residues in soils. Studies were undertaken on the persistence of Glean® and Ally® herbicides in soil. Further trials examined the use of activated carbon and other soil amendments to inactivate persistent herbicide residues in soil.

Field trials were started to assess the effects of environmental factors such as soil temperature, moisture levels and relative humidity on the effectiveness of herbicides. Staff also began growth chamber studies on the influence of soil moisture stress, temperature and relative humidity on the performance of several herbicides.

A special assignment was undertaken to evaluate the potential toxicity to plants of water from irrigation canals lined with polyvinyl chloride.

A further area of research involved studies to develop techniques and information for use in the Centre's investigations of suspected chemical damage to plants. Tests were developed for detecting herbicide residues in soil and water, and the publication "Recognizing Herbicide Action and Injury" was revised and a new edition published.

INSECT PEST MANAGEMENT RESEARCH AND DEVELOPMENT

Insect pest management studies were conducted to develop information on the protection of ornamental and horticultural crops, field crops and livestock.

Staff conducted studies aimed at controlling black fly and other biting fly problems being encountered by livestock producers, and generated information on the impact of biting flies on livestock productivity. These studies focused on developing on-farm control methods, involving the use of backrubbers and electrostatic sprayers which apply synthetic pyrethroid insecticides. Weight gains and grazing behavior in treated and untreated cattle were compared and chemical residues on cattle were determined.

Research was undertaken to evaluate and control insect damage in canola. Staff investigated the impact of flea beetle feeding damage and assessed the incidence of root maggot injury on canola. Reports were completed on bertha armyworm monitoring methods and factors affecting the insect's migration into canola.

Several studies were conducted on chemical and biological control of greenhouse insect pests. Work continued on biological control of greenhouse and other indoor pests, following up on studies the Centre successfully conducted at Muttart Conservatory in Edmonton, beginning in 1981.

One important insect pest under investigation was the greenhouse whitefly. Among several trials conducted was one on the efficacy of mineral oils for control of the insect on cucumbers.

Control of western flower thrips was investigated. A new predatory mite with potential to control thrips was discovered, reared and released. Other trials were conducted on root maggot control in rutabagas.

Survey work included an examination of commercial potato fields for tuber flea beetle distribution, and co-operation with Alberta Agriculture and Agriculture Canada (Lethbridge) on a province-wide pheremone monitoring program for bertha armyworm and three species of cutworms.

PESTICIDE ANALYSIS AND METHODS DEVELOPMENT

Staff undertook the chemical analysis of pesticide residues in water, soil, sediment and vegetation in support of agencies which monitor and enforce various environmental laws in Alberta.

A total of 1,815 samples involving 40,570 parameters was analysed during the year, with more than half of these analyses carried out for Alberta Environment's Pollution Control Division. For example, samples were analysed in support of Alberta Environment programs such as black fly control and pesticide container collection, and Alberta Agriculture grasshopper control work.

A large number of samples was also analysed for Centre projects. Soil, foliage and water samples were analysed for Centre studies on herbicides and herbicide injury diagnostics; cattle hair samples were analysed for insecticide residues as part of the on-farm black fly control study.

Soil and water samples were also regularly tested for pesticides in support of Alberta-wide Public Health Units' programs.

Development of new methods of pesticide analysis was undertaken on an on-going basis.

PLANT PATHOLOGY RESEARCH AND DEVELOPMENT

Several chemical seed treatment field trials were conducted on control of root rot and smut of barley and wheat in co-operation with Agriculture Canada. Field trials were also conducted on the chemical control of seedling blight and sclerotinia stem rot of canola and lentils, and of glume blotch of wheat and net blotch of barley. The influence of herbicides on the development of wheat glume blotch and net blotch of barley was also investigated.

Studies continued into the cause and control of "alfalfa decline", including monitoring the response of alfalfa to different sulphur treatments and inoculating alfalfa plots with three fungi suspected of being associated with the disorder. Studies were started on other aspects of alfalfa decline and on the effect of snow mold on alfalfa cold hardiness, and research began on root and crown rot of sainfoin and alfalfa.

Studies were completed on the range of hosts of verticillium wilt, concluding that in addition to alfalfa, the disease may be harbored on canola, flax, red clover, safflower and soybeans. Trials on annual brassica species were also completed.

Plant disease surveys were carried out to detect newly introduced diseases and to maintain surveillance of established diseases. In co-operation with Agriculture Canada and Alberta Agriculture, fields were surveyed for diseases of alfalfa, barley, wheat and canola. Surveys revealed no cases of verticillium wilt of alfalfa in northeastern Alberta but the incidence of virulent blackleg of canola increased for the third consecutive year.

The cause and control of shoot blight and canker diseases of shelterbelt poplars were also investigated.

Forage research plots

WATER/WASTEWATER MANAGEMENT RESEARCH AND DEVELOPMENT

Studies were undertaken on minimizing environmental impacts on water and to develop information to help assure adequate supplies of high-quality water. This activity encompassed investigations ranging from water and wastewater treatment to the effects of wastewaters and contaminants on aquatic and other organisms.

- Aquatic Toxicology
- Chemical Residues
- Potable Water Technology Research and Development
- Wastewater Technology Research and Development

Electron microscope photo, Giardia cyst

AQUATIC TOXICOLOGY

Staff working in this Program studied the effects of industrial and municipal wastewater on fish and other users of water.

The major emphasis was on alum sludge, a product of municipal wastewater treatment plants. The form of aluminum in water, its binding, its bottom sediments and uptake by fish were initially determined, followed by studies on toxicity to fish and rats. The toxicity of kraft pulp mill effluent was also examined, including 90-day studies on the effects of a simulated effluent on rats. New toxicologic techniques were developed, including cannulations of fish and embryo toxicity methods.

CHEMICAL RESIDUES

Five projects were undertaken in research into the distribution and concentration of environmentally important chemical residues in Alberta.

Scientists investigated chemical residue levels in two bird species — double-crested cormorants and Peregrine falcons. The double-crested cormorant studies examined whether residues in the birds originated in Alberta or elsewhere, and the effects of the chemicals on bird reproduction. Geographic variations in exposure to chemicals in the province were also addressed. Eggs and fat tissue from five cormorant colonies were tested for pesticide and PCB levels.

Pesticide, PCB and mercury residue levels were determined in samples of Peregrine falcon prey such as gulls and pigeons. Analysis of prey tissue collected from four areas of Alberta indicated that the gulls and pigeons are accumulating residues of the insecticide DDT in their overwintering grounds in South and Central America. These residues may impair Peregrine reproduction.

Staff continued studying mercury and its residues in fish in Alberta rivers and lakes. To determine the origin of these residues in fish, soil, sediment and water samples were collected in southern Alberta. This study gathered information on the possibility that mercury residues arise from natural sources, particularly the relatively high levels of the mercury-containing mineral cinnabar in southern Alberta soils.

Using information gathered about mercury residues, staff developed fish consumption guidelines for various species and locations in Alberta.

POTABLE WATER TECHNOLOGY RESEARCH AND DEVELOPMENT

Scientists at the Centre tested and evaluated new and current technology for dealing with drinking water problems in Alberta. A newly-delivered pilot scale mobile water treatment plant served as the major facility for this work.

In co-operation with the Kananaskis Centre for Environmental Research, the Centre used the mobile facility to study Giardia, the organism which causes giardiasis ("beaver fever") and the effectiveness of various treatment processes for removing or inactivating this organism in drinking water.

A smaller water treatment research unit designed and built by an Alberta engineering firm was acquired for further on-site studies.

Water treatment specialists from the Centre and from Alberta Agriculture also planned studies to evaluate processes and hardware for treating drinking water for single dwellings.

Other areas of concern in the Program included treatment of groundwater and surface waters receiving pulp mill effluents.

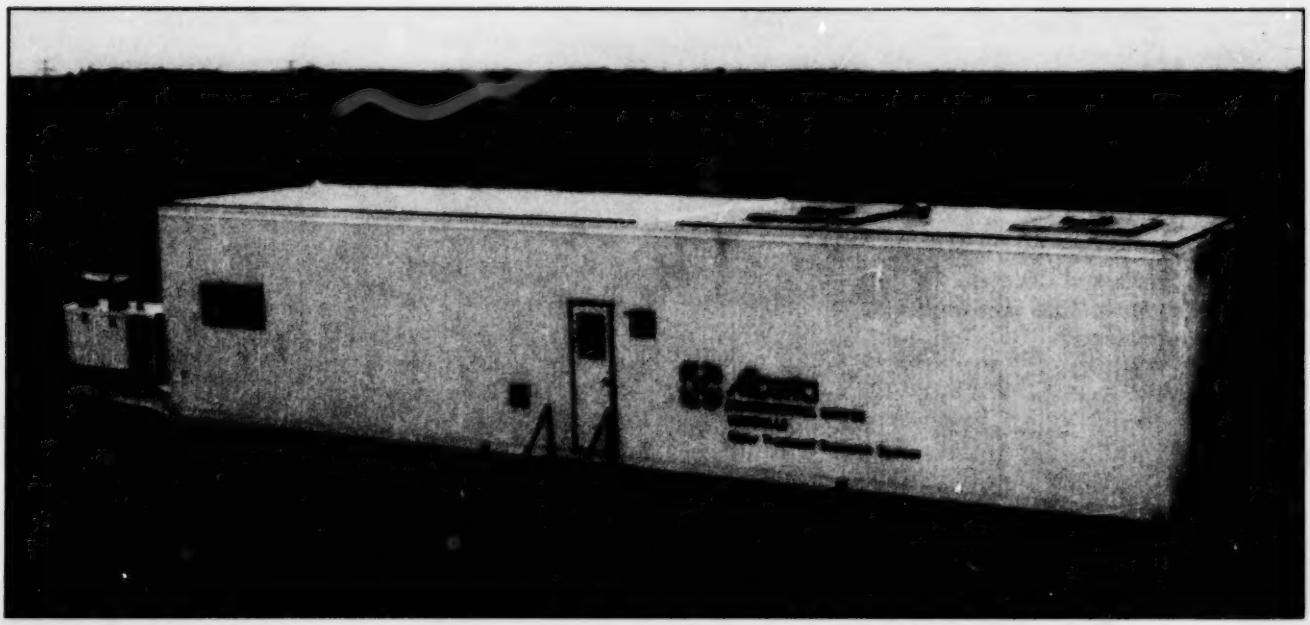
WASTEWATER TECHNOLOGY RESEARCH AND DEVELOPMENT

The Centre undertook studies to evaluate and improve processes and hardware for treating specific wastewaters. Information generated was used by Alberta Environment to evaluate proposals for wastewater treatment and discharge.

In one project, staff conducted a detailed assessment of an industrial proposal to use chlorine to remove color from kraft pulp mill effluent. This included use of scale model lagoons and rat bioassays to evaluate physical and biological aspects of the chlorine decolorization process.

Biological wastewater treatment processes were also examined, with work concentrating on polymers produced by fermentation as a potential means of removing color from pulping effluent.

Tritium tracer techniques were used to determine effluent residence time in pulp mill waste lagoons.



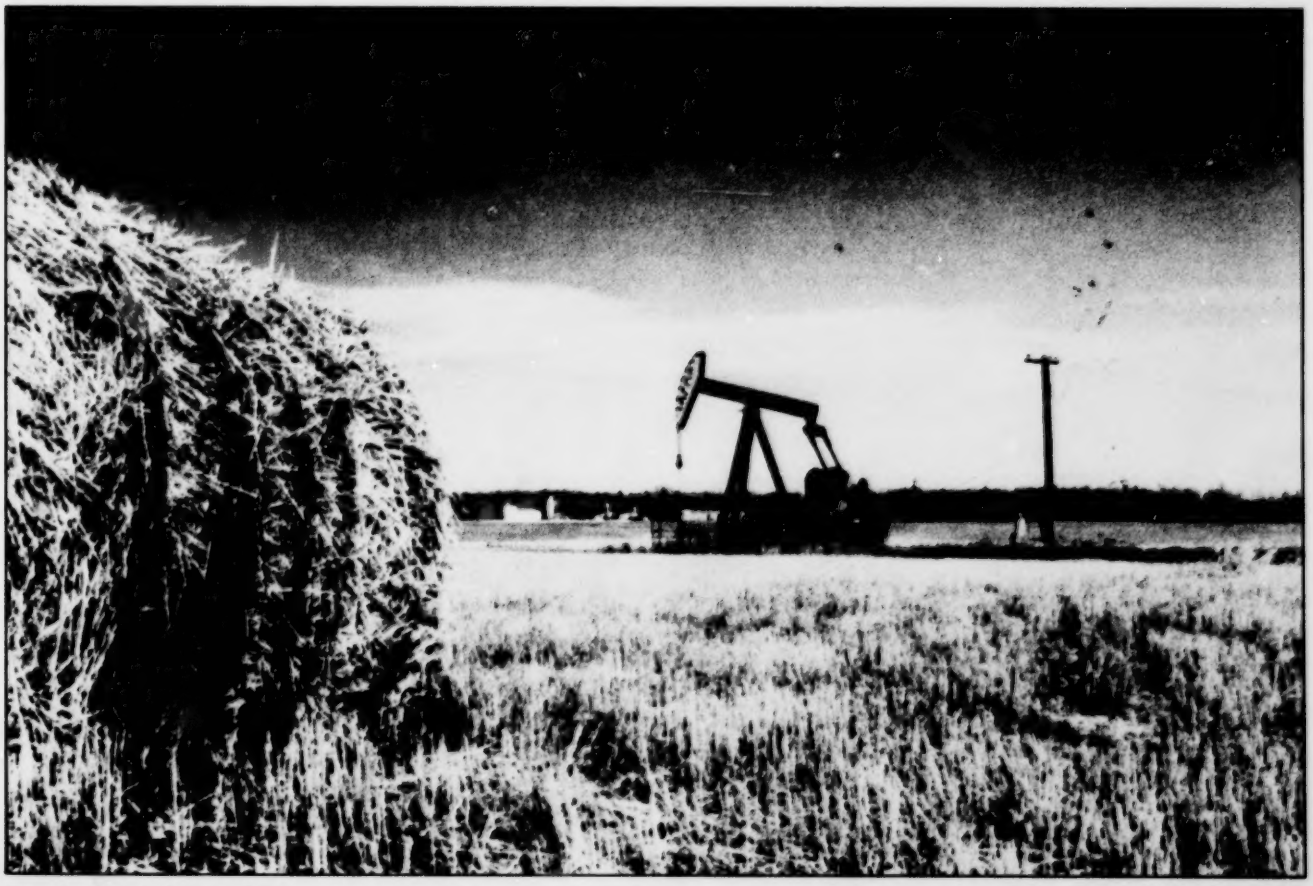
Mobile water treatment plant

ENVIRONMENTAL TOXICOLOGY

The potentially harmful consequences of chemicals or agents of natural or human origin were examined in this Program Area.

PROGRAMS:

- Chemical Safety Evaluation
- Environmental Sulphur
- Inhalation Toxicology
- Toxicology of Biocides
- Toxicology of Petrochemicals and Fossil Fuels



Petroleum/agriculture studies

CHEMICAL SAFETY EVALUATION

This Program was set up on a contingency basis to develop the capability for complete safety evaluations on chemicals of notable environmental concern. This year no requests for work of this depth and extent were received.

ENVIRONMENTAL SULPHUR

Researchers in this Program studied the environmental effects of sulphur emissions with particular emphasis on direct and indirect effects on livestock. During the year they analysed and reviewed data from two major experiments and completed a study on the effects of high dietary sulphur on enzyme activities, blood selenium and body weights of cattle.

INHALATION TOXICOLOGY

Using custom-designed inhalation exposure chambers researchers undertook a series of studies on the toxicity of hydrogen sulphide. One study investigated the relationship between concentration and length of exposure, as well as the influence of sex and strain of laboratory rat, on the toxicity of hydrogen sulphide. An exposure model was developed to study the effects on the rat of exposure to hydrogen sulphide for four hours. A series of experiments was started, using this exposure model, to study the toxicity of single and repeated exposures to hydrogen sulphide.

A number of new techniques was developed to evaluate toxicity. Light and electron microscopy, as well as computer-assisted morphometry, were used to detect morphological changes in the respiratory tract. Biochemical assays of lung lavage fluids and body tissues were conducted to detect changes in the activity of enzymes. In addition, several cell culture methods were employed to study the effects of hydrogen sulphide toxicity.

The installation of five 2,000 litre inhalation chambers proceeded in the new 360 square-metre inhalation toxicology containment facility. Considerable effort was directed toward bringing this facility to operational status, with special emphasis on the fourteen air handling systems required to maintain containment, as well as installation of the inhalation toxicology monitoring, control and safety systems.

TOXICOLOGY OF BIOCIDES

Researchers undertook several studies into the effects of pesticides on non-target species. One series of studies investigated the toxicity of the insecticide methoxychlor to fish. These studies were designed to answer questions about the fate of the chemical in the environment, its toxicity to the early life stages of fish, and the potential toxicity of the emulsifier associated with the pesticide.

Staff completed several biochemical studies into the effects of organophosphate insecticides on cattle. Treatment of cattle with selected organophosphate insecticides at the manufacturer's recommended doses produced measurable decreases in acetycholinesterase enzyme activity. The duration of this effect was consistent with reduced performance in livestock as reported by Alberta producers. Several short term studies were also undertaken to assess the environmental effects of a grasshoppers spraying programme. These studies involved simulated exposure of game birds, particularly ringneck pheasants, to insecticides used in the spray programme.

TOXICOLOGY OF PETROCHEMICALS AND FOSSIL FUELS

This Program was established to study the toxicity of crude oils, heavy oils, bitumen, drilling fluids and other petroleum related products. Emphasis was on the potential toxicity of these substances to cattle and fish populations.

Two preliminary experiments were carried out to assess the biochemical effects of crude oil ingestion on laboratory animals. Information was also collected on the resulting pathological changes in liver, kidney and other tissues. In addition, several enzyme assays were adopted for the next stage of this research involving the effects of crude oil ingestion on range cattle.

Staff investigated the potential toxicity to fish of bitumen which seeps naturally into the Athabasca River in the oil sands region. This involved determining the level of certain hydrocarbons in fish tissue and the toxicity of different fractions of bitumen to fish.

Inhalation exposure chamber

LIVING NATURAL RESOURCES

Fish, moose, bear, elk, coyotes and a variety of other species were the focus of work in this Program Area. Staff travelled widely in Alberta conducting studies on a range of environmental changes which may affect living natural resources.

PROGRAMS:

- Aquatic Habitat Studies
- Forestry Development and Wildlife Resources
- Humane Trapping
- Problem Wildlife
- Wildlife Productivity

Elk

AQUATIC HABITAT STUDIES

A study of the Dickson Dam was launched to monitor native and stocked fish populations, providing information needed to manage fisheries resources in Alberta reservoirs.

The study was designed to describe changes in mercury levels in fish in the Dickson reservoir and changes in the species composition of the fish population. Nine collection trips were made and the fish were examined to determine species dominance, age, sex and size and other information. Muscle samples were removed for mercury analysis and stomach contents were examined to determine diet and major prey. A creel census was conducted to determine angler use of the reservoir and catch of stocked species.

FORESTRY DEVELOPMENT AND WILDLIFE RESOURCES

This large field Program entered its final phase with concentration on analysis and reporting of data collected during five years of study on the effects of forestry operations on wildlife in the Berland Timber Management area. The information was generated through studies including the capture of over 50 grizzly and black bears and surveillance of 38 of them equipped with radio collars.

As well, satellite imagery was used to prepare detailed habitat maps of the area, and to relate animal activity to habitat.

Information was being analysed on such topics as bear population biology, home range area, food habits and use of electronic devices for wildlife studies.

HUMANE TRAPPING

Facilities were built and research started in this Program under an agreement between the Fur Institute of Canada and the Province of Alberta to undertake a co-operative program of research into humane trapping systems. The major goal of the research is to identify or develop trapping devices for terrestrial fur-bearing animal species that will allow the most effective harvest of the species. A detailed project plan was developed, focusing on the study of raccoon, marten and mink.

PROBLEM WILDLIFE

Staff continued research into the control of two vertebrate pests of agricultural concern — coyotes and pocket gophers.

Toxic collars on lambs were tested as a management tool to control coyote predation of sheep. Three trials were run to test the effectiveness of a tape playing device for use in conjunction with toxic collars.

Researchers initiated a study to examine the potential of above ground control of pocket gophers in hay fields. This involved live trapping of the animals and equipping them with tracking devices allowing an estimation of their above-ground movement and the likelihood of their taking broadcast bait.

A study was also started on the potential of controlling pocket gophers with a toxicant-glue mixture which would stick to the animal's fur and be ingested during grooming.

A diagnostic service was provided to Alberta Agriculture, involving the identification of animals in cases of suspected rat infestations.

Bison

WILDLIFE PRODUCTIVITY

Staff undertook research to improve the productivity of wildlife and their habitats with particular emphasis on studies that will generate knowledge required for intensive game production.

These studies were conducted at three sites — the Kikino Game Ranch near Lac La Biche, vegetation plots near Hinton, and the Centre. They encompassed investigations into the general areas of resource and habitat management, and into the interaction between animals and their environment. In co-operation with personnel at Kikino Game Ranch, a game ranching study was undertaken. This research was designed to collect information on the interactions between animals and their environments and on the environmental resources required for game ranching.

Studies also began on the palatability and suitability of forages for elk. Grass plots were established for these trials using forages which show potential for revegetation of disturbed, high-elevation lands.

Staff continued work on the development of a prototype backpack monitoring system to collect environmental and behavioral information from free-ranging wildlife. Calibration and testing of the system was carried out. In related work, researchers completed investigations into early winter mortality and antler casting in Elk Island National Park.

Staff also provided information on bison management to government personnel.

WASTE MANAGEMENT RESEARCH AND DEVELOPMENT

Physical, chemical and biological processes for waste management were studied to reduce environmental problems and exploit the economic potential of wastes. This involved laboratory and pilot scale studies at the Centre and in the field.

PROGRAMS:

- Emission Control Technology
- Microbiological Processes in Waste Management
- Technology Development in Waste Management
- Thermal Conversion Processes

Bench-scale fermentation unit

EMISSION CONTROL TECHNOLOGY

Two reports were compiled following successful completion of an on-site, bench scale evaluation of sulphur dioxide removal processes from natural gas processing plant emissions. Discussions were held with industry and government about the possibility of extending the study to include pilot-scale evaluation of promising scrubbing processes for natural gas and oilsands plants.

MICROBIOLOGICAL PROCESSES IN WASTE MANAGEMENT

Researchers carried out projects to provide information on the environmental effects, toxicity and management of wastes using microbiological processes and systems.

One project assessed the impact of cattle feedlot wastes on the quality of adjacent receiving surface waters. Runoff from six feedlots was sampled during snow melt and storms. Ninety-four collected samples were then analysed for 6,351 microbiological parameters. Data were analysed and a paper based on the findings was presented at an international workshop.

Staff continued working on the development of microbial tests for determining the toxicity of environmental samples, focusing on *Pseudomonas fluorescens*. The growth rate of this bacterium may be affected by toxicants, thereby providing a simple test for the toxicity of aquatic samples. This work involved the testing of 116 samples for 921 parameters.

Work progressed on the use of bacteria to remove heavy metals from wastes such as sewage sludge. A number of experiments, involving about 360 samples and 2,630 parameters, was conducted on the hexavalent form of chromium for determining its tolerance in selected microorganisms, its effects on soil microflora, and its uptake and accumulation using raw sewage in contact with a continuously operated rotating biodisc contactor.

TECHNOLOGY DEVELOPMENT IN WASTE MANAGEMENT

This Program was directed toward assessing and developing waste management processes that have potential applications in Alberta. Waste fixation and solidification studies, and evaluation of fermentation processes in waste treatment were emphasized.

In the area of waste fixation and solidification, the Centre participated in a co-operative study with the United States Environmental Protection Agency, Environment Canada and vendors of waste solidification and stabilization processes. The broad objective of the study was to determine the suitability of various processes for managing wastes in Alberta. More specifically, staff worked on the development, assessment and use of laboratory test methods for characterizing the ability of processes to stabilize wastes effectively. Staff also worked with industry in the evaluation and development of specific solidification processes.

In a second project, researchers investigated the production and use of chitosan, a polymer which may find use in a variety of waste management applications such as flocculation and heavy metal absorption. Work included production and characterization of chitosan in a pilot-scale fermenter and assessment of potential uses in Alberta.

THERMAL CONVERSION PROCESSES

Researchers in this Program conducted studies to assess and develop thermal processes for the disposal or use of wastes and to develop sound and safe operating practices for incinerators.

A significant effort was directed towards development of an advanced incineration research system. A major accomplishment was construction of a 467 square-metre incineration research building. To study incinerator operation and design, a pilot-scale incinerator with scrubbers and a laboratory-scale system for incineration research were put in place. Systems for continuous incinerator stack gas sampling and analysis were acquired in order to characterize and measure emissions.

In part to test the incinerator monitoring and analytical system, trials were conducted at a major hospital incinerator. Project staff also carried out experiments on bench-scale scrubbing and lime injection to control hydrochloric acid emissions from hospital incinerators.

Incineration facility

LAND RESOURCES MANAGEMENT RESEARCH AND DEVELOPMENT

Land resources studies focused on research in soil reclamation and revegetation. These studies were aimed at gathering information for restoring the productivity of disturbed lands.

PROGRAMS:

- Environmental Impact on Soil Ecology
- Native Species for Reclamation Research and Development
- Soil Reclamation Research

Native grass selection

ENVIRONMENTAL IMPACT ON SOIL ECOLOGY

This program starts from the assumption that unique strategies of soil and plant management can provide cost-effective alternatives to correcting environmental upsets.

In one successful experiment, plants were used to remove water from slow draining oilsand and sludge mixes generated during bitumen recovery from the Athabasca oilsands. From an initial list of 23 plant species, two species were identified as having the potential to extract large amounts of water from the waste mixtures.

Another field experiment was established to measure the effect of plant growth on soil water depletion and salt movement. The objective is to find cropping systems which will control water flow in soils subject to salinization.

NATIVE SPECIES FOR RECLAMATION RESEARCH AND DEVELOPMENT

Researchers in this Program worked toward the development of native plant species for use in reclamation, erosion control and wildlife range improvement on the eastern slopes of the Rockies. The goal is to eventually license lines which can be produced by seed growers.

From initial plant collections in the east slopes area, four species were selected as showing potential. Collected plants were transplanted to the Centre nursery for tests on the genetic and agronomic characteristics of the species. Selected species were also planted in performance tests at the Centre as well as in the east slopes area near Coleman, Lookout Mountain and the Columbia Ice Fields.

One objective of the research is to develop grasses which will improve winter and early spring wildlife ranges. Staff therefore conducted studies to determine which plants are palatable to wildlife.

Researchers were successful in overcoming the seed dormancy problem in shrubs which show promise for oil sands mine reclamation in northern Alberta. After collecting saskatoons, dogwoods and silverberries, researchers determined that the dormancy trait is genetic and that it is possible to select for non-dormant types.

SOIL RECLAMATION RESEARCH

Centre staff undertook research to improve the methods of reclaiming disturbed soils, especially those high in sodium and dissolved salts. Emphasis in these studies was on plant growth and water movement, both of which tend to be restricted in high sodium soils.

Among specific projects undertaken was a study into the control of water movement in high sodium materials. These studies led to the development of an improved method for measuring water movement in these soils and spoils. Soils specialists also completed a major experiment on the effect of sodium concentration on plant growth and root development, and identified plants capable of rooting in sodic materials.

Staff also continued expanding the Centre's province-wide collection of high sodium soils and spoils for use in experiments.

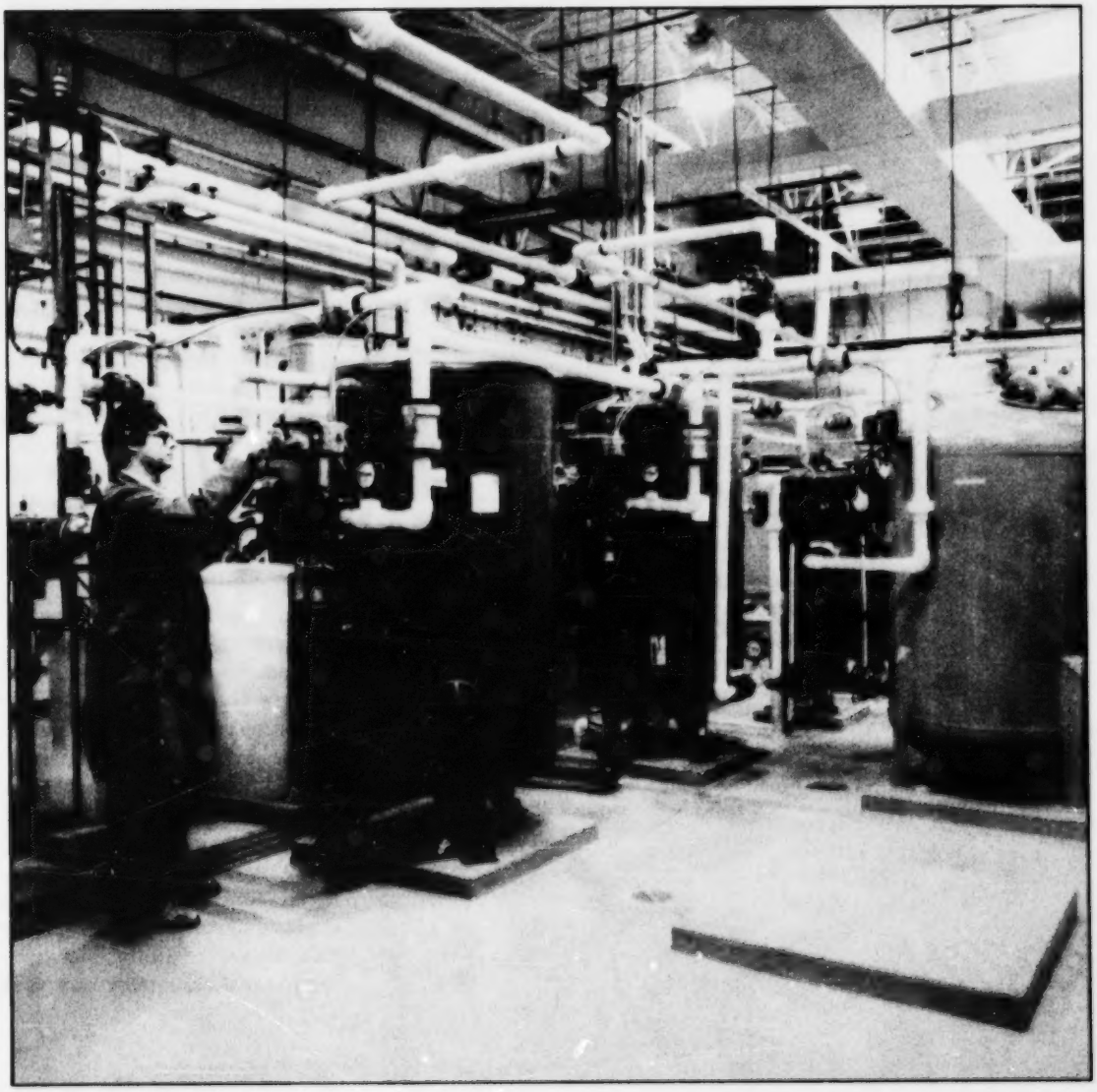
Recording field data

TECHNICAL SUPPORT

Specialized technical support services were provided to the Centre's scientific and technology development activities. These services ranged from the development of computer facilities for laboratories to the design and building of electronic devices for collecting research data.

PROGRAMS:

- Animal Resources
- Capital Facilities Development
- Controlled Environments
- Instrumentation Services
- Pathology Services
- Site Environmental Services
- Site Support Services
- Technical Services — Electronic Data Processing



Recycle water treatment plant

ANIMAL RESOURCES

An Animal Care Committee, set up to oversee the care and use of animals, reviewed experimental procedures for animal-based studies according to guidelines set by the Canadian Council on Animal Care (CCAC). A CCAC delegation visited the Centre to review animal care, and reported favorably.

Veterinary services were provided to all animal users on a 24-hour basis, and improvements in equipment, record keeping, procedures and other aspects of animal care were instituted.

CAPITAL FACILITIES DEVELOPMENT

Several capital development projects were undertaken to provide the physical facilities needed for Centre work. Major projects included construction of an incineration research facility, and animal pens and a core research building for humane trapping studies. Some main building laboratory space was also completed and plans were finalised for construction of an experimental greenhouse. Commissioning tests for the new inhalation toxicology laboratory were conducted.

CONTROLLED ENVIRONMENTS

Staff operated controlled environment growth chambers used for plant research purposes and provided technical assistance and horticultural advice on the propagation of plants for research. Thirty-six growth chambers and four seed germinators were operated at capacity, providing year-round growing conditions for plant and pest studies.

INSTRUMENTATION SERVICES

Staff repaired and maintained various instruments at the Centre and designed and developed electronic equipment and systems in support of Centre studies.

Maintenance programs were carried out for equipment such as growth chambers, mobile and recycle water treatment plants, a fermenter and computers. A Centre-wide study of maintenance requirements was undertaken with a view to improving services.

Electronic specialists also developed measurement and test facilities for a variety of research projects. For example, instrumentation and controls were established for the Centre's recycle water treatment plant. A prototype device was completed for the collection of data on animal-environment relationships and development was started on an instrument for the in-place collection of information on plant roots.

PATHOLOGY SERVICES

Staff in this Program provided essential services to all animal-based research at the Centre, analysing changes in tissues and fluids of the animals under study.

These services were provided largely in support of toxicology-related work, such as inhalation toxicology, toxicology of pulp mill effluent, toxicity of petrochemicals and fossil fuels, toxicology services, livestock insect pest management, toxicity of methoxychlor to fish, and the humane trapping program.

Staff provided similar pathology services for various wildlife biology studies.

More than 900 animals were examined after death, over 13,600 animal tissues were prepared for histological evaluation, more than 100 for electron microscope evaluation, and more than 13,000 individual tests were carried out on blood samples. Computer-based data capture systems were implemented for morphometric analysis of tissue and for clinical chemistry analyses.

SITE ENVIRONMENTAL SERVICES

An integrated waste management program was provided to minimize the Centre's impact on the site and local environment. This involved the operation of an interim wastewater treatment plant, a pesticide waste storage system and a system for handling concentrated wastes. During the year about six million litres of laboratory wastewater were processed through the treatment system, 40,000 litres of waste were handled in the pesticide waste program, and over 2,500 kg of concentrated wastes were handled.

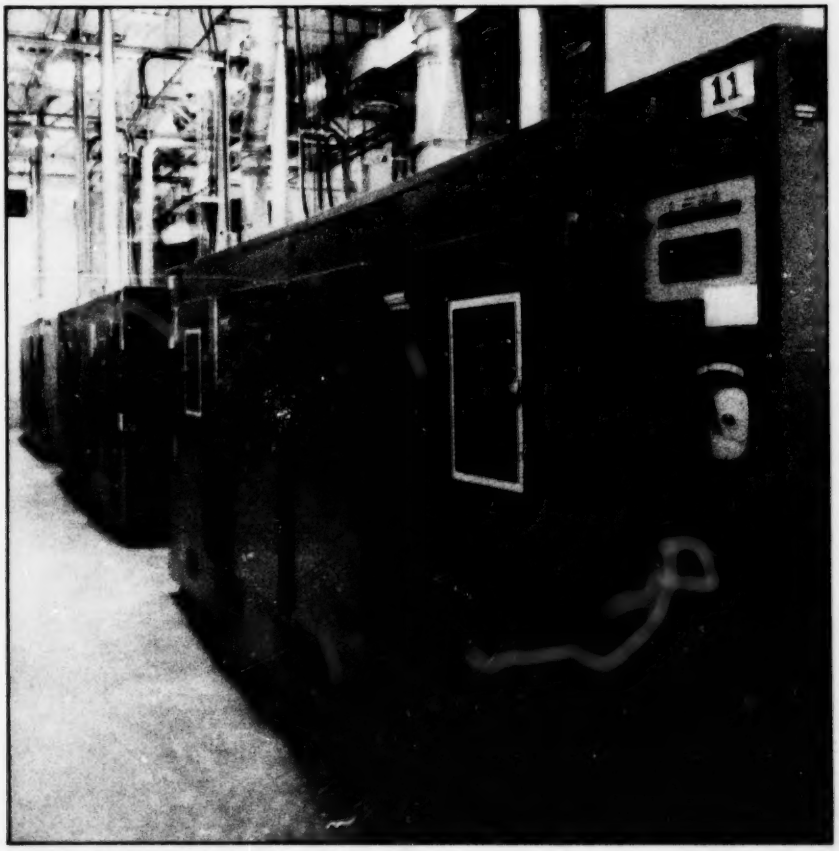
Staff also operated three specialized water treatment facilities — a recycle treatment plant supplying water to fish tanks, a reverse osmosis unit and an ion exchange system providing laboratory quality water.

SITE SUPPORT SERVICES

Site support staff co-ordinated activities on the 300 hectares of land associated with the Centre. Approximately one third of their effort was directed toward supporting research efforts through activities such as development and maintenance of crop research plots and equipment repair and design. Numerous site development efforts were undertaken such as fencing of elk pastures and seeding of hay fields. A large fleet of equipment and machinery was co-ordinated and maintained.

TECHNICAL SERVICES — ELECTRONIC DATA PROCESSING

Staff continued developing services and facilities to provide computing support for the Centre. The major focus was on customizing and enhancing software for the mainframe computer to allow computer collection of data produced in Centre chemistry laboratories. Staff were also involved in planning an electronic communications system to allow computer resource sharing and communications.



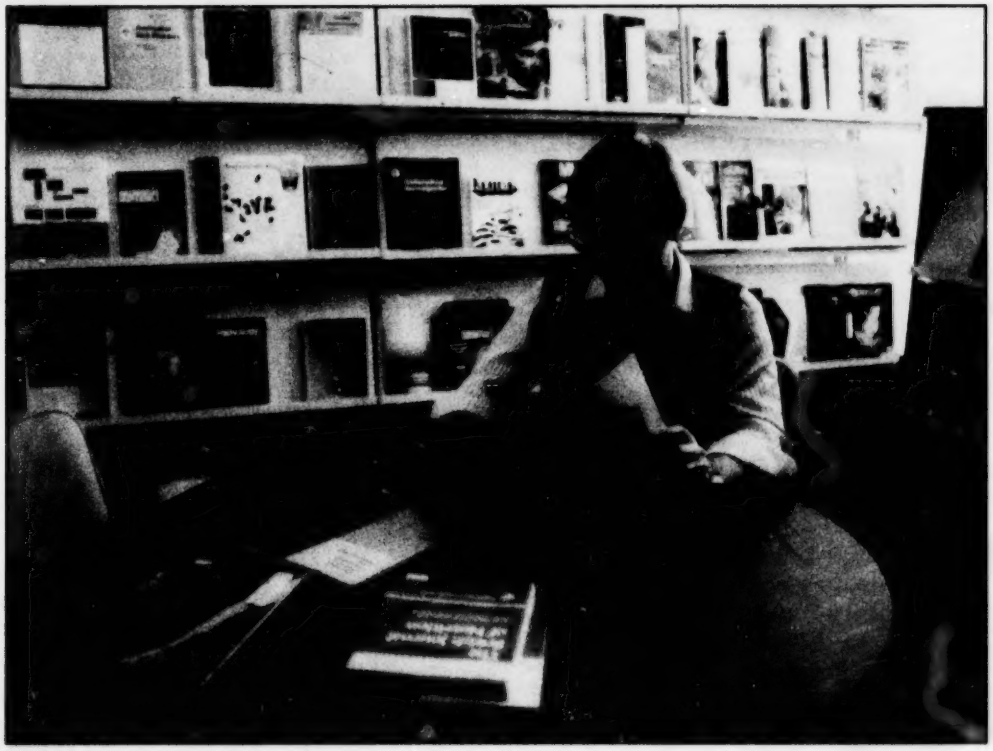
Growth chambers

ADMINISTRATIVE SUPPORT

Administrative support services were provided as needed to advance the Centre's research, technology development and client services objectives. This support was provided to all Wings by the Common Services Wing, by administrative units attached to each Wing and through the management of the Centre facilities.

PROGRAMS:

- Administrative Services — Animal Sciences Wing
- Administrative Services — Chemistry Wing
- Administrative Services — Common Services Wing
- Administrative Services — Environmental Technology Wing
- Administrative Services — Plant Sciences Wing



Library

ADMINISTRATIVE SERVICES — ANIMAL SCIENCES WING

Management and administrative services were provided for Animal Sciences Wing activities and an experimental design and data analysis service was offered throughout the Centre. A major administrative effort was expended during the year in the implementation of an office information system and in providing administrative support for humane trapping studies.

ADMINISTRATIVE SERVICES — CHEMISTRY WING

Administrative and office services were provided in support of Chemistry Wing activities. In addition to purchasing, staffing and related administrative functions, a major task was the processing and distribution of around 26,500 chemical analysis reports. Considerable effort was also spent in implementing an office automation system. Staff also drafted Chemistry Wing administration and purchasing manuals.

ADMINISTRATIVE SERVICES — COMMON SERVICES WING

Library, financial, communications, personnel and related functions were performed in support of activities requiring services that are common to the Centre.

The Library continued its central role in technical projects, providing information to staff through manual and computer-assisted reference searches, collection development, inter-library loans and similar services. For example, more than 115 in-depth, on-line computer reference searches and more than 715 manual reference searches were completed. The Library also processed over 4,800 incoming inter-library loan requests and operated a central records unit.

Financial services centred around the preparation and administration of the Centre's $11 million budget. This involved operation of an accounts section processing around 2,800 invoices annually, a central stores facility receiving up to 700 items a day, and an active central duplicating facility. In addition to performing general administrative duties, staff implemented an office automation system.

Communications staff provided information about Centre activities through a variety of means. A new informational brochure and an Annual Review were produced, and a quarterly newsletter was initiated. More than 700 people were given tours of the facility while another 450 attended an open house. Some 57 news media contacts were recorded.

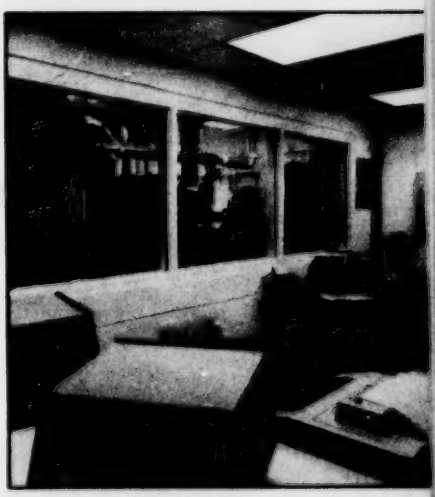
Personnel services staff were involved in recruitment, payroll, classification, training and similar staff relations functions. As well, an active occupational health and safety program was offered. More than 20 work-related courses were provided and an emergency response team was active.

ADMINISTRATIVE SERVICES — ENVIRONMENTAL TECHNOLOGY WING

Four projects were carried out in order to administer the manpower and financial resources of the Environmental Technology Wing. One project provided for the budgeting, clerical, staffing, planning and management requirements of the Wing. Another included the development and management of facilities such as the Incineration Research Building which was built during the year. Included in an active staff training and development program was a contract to train a staff member from Chem Security Ltd., operating contractor to the Alberta Special Wastes Management Corporation, in waste stabilization processes. New project development activities included a consideration of bio-polymers in waste management, and stable isotope studies.

ADMINISTRATIVE SERVICES — PLANT SCIENCES WING

This Program provided administrative support for the research and service activities of the Plant Sciences Wing. Among major administrative tasks undertaken were planning and development of laboratory bays, and preparing proposals for construction of greenhouses and a service building. Administrative staff were also involved in arrangements for the Centre's first research project to be carried out on a cost-sharing basis with private industry.



Power plant control room

ALBERTA ENVIRONMENTAL CENTRE

PROGRAM/PROJECT LISTS 1985/86

PROGRAM	PROJECT/ SUB-PROJECT	CLIENT AGENCY
Air Analytical Services	Health Units Pollution Control Division Standards & Approvals Division Alberta Environmental Centre Others	Environment, Alberta Environmental Centre, Social Services & Community Health
Animal Resources	Laboratory Animal Services Livestock Services Aquatic Animal Resources Wildlife Animal Resources	Alberta Environmental Centre
Aquatic Biology Services	Aquatic Biology Services Water Treatment System Environmental Bioassay Services Environmental Issues in Western Society	Energy & Natural Resources, Environment
Aquatic Habitat Studies	Dickson Dam Ecological Study	Energy & Natural Resources, Environment
Aquatic Toxicology	Biological Monitoring R & D Toxicity Evaluation of Industrial Wastewaters Toxicity Evaluation of Municipal Wastewaters	Energy & Natural Resources, Environment
Biological Control of Weeds R & D	Priority List of Weeds Survey of Arthropods Release and Monitoring Biology and Host-specificity Post-establishment Studies Surveys of Plant Pathogens	Agriculture, Energy & Natural Resources
Biology and Ecology of Weeds R & D	Biology of Weeds of Alberta Weed Crop Competition Weed Surveys Taxonomy of Weeds of Alberta Biology and Control of Aquatic Weeds Special Assignments	Agriculture, Energy & Natural Resources, Environment
Capital Facilities Development	Laboratory Space Inhalation Toxicology Facility Experimental Incinerator Facility Research Greenhouse Facility Wildlife Handling Facility Large Animal Facilities Lecture Theatre Site Development & Park	Alberta Environmental Centre
Chemical Residues	Geochemistry of Mercury in Southern Alberta Mercury Residues in Fish Speciation of Heavy Metals Chemical Residues in Colonial Nesting Birds Chemical Residues in Peregrine Falcons	Energy & Natural Resources, Environment
Chemical Safety Evaluation		Agriculture, Workers' Health, Safety & Compensation, Environment
Controlled Environment	Growth Chambers	Alberta Environmental Centre
Electron Microscopy	Health Units Pollution Control Division Alberta Environmental Centre Other Alberta Agriculture Alberta Research Council	Social Services & Community Health, Alberta Research Council, Agriculture, Environment, Alberta Environmental Centre
Emission Control Technology	On-site Pilot-scale Tests of Wet Scrubbing Processes for SO_2 Removal at a Gas Plant On-site Evaluation of a Wet Scrubbing Process for SO_2 Removal at a Tar Sands Plant	Environment
Environmental Impact on Soil Ecology	Assessment of Pollution Impact on Soils Biological Dewatering of Tailings Sludge	Environment

Environmental Isotopes	Development of Methods & Systems Radiation Liaison Services C-14 & H-3 Environmental Research and Applications	Agriculture, Alberta Research Council, Culture, Energy & Natural Resources, Environment
Environmental Sulphur	Effects of Sulphur on Livestock Production	Agriculture, Environment
Forestry Development and Wildlife Resources	Industrial Development and Wildlife in the Boreal Forest	Forestry
Herbicides and Weed Management R & D	Performance Evaluation of Herbicides Crop Safety and Tolerance to Herbicides Behavior and Fate of Herbicides in Plants Behavior and Fate of Herbicides in Soil	Agriculture, Environment
Humane Trapping	Program Development	Energy & Natural Resources, Agriculture, Fur Institute of Canada
Inhalation Toxicology	Inhalation Toxicology Systems Development Health Effects of Sulphur Gases	Workers' Health, Safety & Compensation, Agriculture, Environment
Insect Pest Management R & D	Special Crops Insect Pest Management R & D Field Crops Insect Pest Management R & D Livestock Insect Pest Management R & D	Agriculture
Instrumentation Services	Repair & Maintenance of Laboratory Instruments Engineering and Systems Design	Alberta Environmental Centre
Lake Nutrients	Lake Nutrients	Environment
Microbiological Services	Microbiological Enumeration Services Microbiological Identification Services Microbial Toxicity Services	Agriculture, Environment, Alberta Environmental Centre
Microbiological Processes in Waste Management	Survey of Feedlot Wastes Microbial Toxicity Development Microbial Metabolism of Toxicants	Agriculture, Environment, Alberta Environmental Centre
Native Species for Reclamation R & D	Native Species for Reclamation — East Slopes Native Species for Reclamation — Northern Alberta Native Species for Reclamation — Southern Alberta	Environment, Energy & Natural Resources
Pathology Services	Necropsy Services Histopathology Services Clinical Pathology Services Ultrastructural Pathology Services	Alberta Environmental Centre
Pest Management Diagnostic and Extension Services	Insect Diagnostic and Extension Services Plant Disease Diagnostic and Extension Services Weed Diagnostic and Extension Services Chemical Damage Diagnostic and Extension Services	Agriculture, Social Services & Community Health, Environment
Pesticide Analysis and Methods Development	Health Units Pollution Control Division Alberta Environmental Centre Other	Social Services & Community Health, Energy & Natural Resources, Agriculture, Environment
Plant Pathology R & D	Disease Management in Cereals, Oilseeds, and Special Crops Disease Management in Forage Crops Disease Management in Woody Ornamentals, Shelterbelts, and Turf	Agriculture, Environment
Potable Water Technology R & D	Treatability of Surface Waters Subject to Effluents from Pulp Mills Giardia Cyst Removal and Inactivation Groundwater Treatment	Public Works, Supply & Services, Environment, Agriculture, Social Services & Community Health
Precipitation Studies	Pollution Control Division Long Range Transport (LRTAP) Research Management Division Others	Environment, Alberta Environmental Centre
Problem Wildlife	Diagnostic and Field Investigative Services Vertebrate Pest Management Chemical Control of Problem Wildlife	Agriculture

Quality Control and Data Management	Alberta Environmental Centre Quality Control Alberta Environment Quality Control External Quality Control	Social Services & Community Health, Energy & Natural Resources, Environment, Alberta Environmental Centre
Research Services — Chemistry	Health Units Pollution Control Division Alberta Environmental Centre Other	Energy & Natural Resources, Health Units, Environment, Alberta Environmental Centre
Site Environmental Services	Incineration of Wastes Disposal of Laboratory Wastewater Laboratory Grade Water Supply Water Recycle and Treatment System	Alberta Environmental Centre
Site Support Services	Site Administrative Services Site Development Services Site Equipment Services Site Operation Services Site Research Support Site Vehicle Services	Alberta Environmental Centre
Soil Analytical Services	Soil Analytical Services Soil Mapping and Geostatistical Services Soil Analytical Methods Development	Environment, Alberta Environmental Centre
Soil Reclamation Research	Sodic Spoil Behaviour Water Use and Salt Transport	Agriculture, Energy & Natural Resources
Technology Development in Waste Management	Fixation of Wastes Evaluation of Fermentation Processes in Waste Treatment	Environment, Alberta Special Wastes Management Corporation
Technical Services — Electronic Data Processing	Chemistry Lab Information Management Systems Lab Systems for Animal Sciences Lab Systems for Plant Sciences Environmental Technology Lab Systems Requirements Operational & Technical Support	Alberta Environmental Centre
Thermal Conversion Processes	Development of Incineration Research Systems Hospital Wastes Incineration Oilfield Wastes Incineration	Hospitals & Medical Care, Environment, Alberta Special Wastes Management Corporation
Toxicology Services	Toxicology Services Toxicology Information Services Genetic Toxicology Development Reproductive Toxicology Development In Vitro Toxicology Development	Agriculture, Energy & Natural Resources
Toxicology of Biocides	Program Development Toxicology of Methoxychlor to Fish Toxicology of Insecticides on Livestock Environmental Effects of Grasshopper Control Activities	Agriculture, Energy & Natural Resources, Environment
Toxicology of Petrochemicals and Fossil Fuels	Program Development Hydrocarbons in Fish Toxicity of Tar Sand Holding Pond Effluent Toxicity of Petrochemicals to Livestock Toxicity of Crude Oils	Agriculture, Energy & Natural Resources, Environment
Trace Organic Analysis and Methods Development	Health Units Pollution Control Division Alberta Environmental Centre Other	Social Services & Community Health, Energy & Natural Resources, Environment, Alberta Environmental Centre
Wastewater Technology R & D	Treatment of Pulp Mill Effluent for Colour, Taste and Odour Removal Sewage Lagoon Modelling	Environment
Water Analytical Services	Health Units Pollution Control Division Alberta Environmental Centre Others	Social Services & Community Health, Energy & Natural Resources, Recreation & Parks, Environment
Wildlife Biology Services	Wildlife Biology Services	Environment, Energy & Natural Resources, Alberta Environmental Centre
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American Society for Testing and Materials, Methods for Physical/Chemical Characterization of Wastes
American Society for Testing and Materials, Microbiological Methods Committee
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Expert Committee on Weeds (Western Canada), Research Planning Committee
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Occupational Health and Safety Heritage Grant Program — Grant Review
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Western Committee on Plant Disease Control
Western Committee on Plant Disease Control, Ornamental Disease Subcommittee
Western Committee on Plant Disease Control, Special Crops Subcommittee
Wildlife Society, Certification Review Board
Wildlife Society, Professionalism Committee

PUBLICATIONS

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* Experimental work done elsewhere

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1985 - 86 FISCAL YEAR EXPENDITURES

(Thousands of dollars)

	Manpower	Supplies & Services	Grants	Fixed Assets	Total
Program Support	1238	1134	3	119	2494
Plant Sciences	1265	286	—	246	1797
Chemistry	2056	329	—	391	2776
Animal Science	1667	588	—	164	2419
Envir. Tech.	1140	362	—	534	2036
TOTAL	7366	2699	3	1454	11522

(This is not an audited statement.)

ORGANIZATION CHART